 0030-0950/83/0001-0022 $2.00/0

PRAIRIES LOST TO FORESTS: A 33-YEAR HISTORY OF TWO SITES IN ADAMS COUNTY, OHIO[1]

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ABSTRACT. Aerial photographs taken in 1938, 1950, 1965, and 1971 were examined to determine the extent of conversion from prairie to forest for the Lynx Prairie Preserve and a nearby, privately owned property. Both locations, in Adams County, Ohio, supported extensive prairie areas in 1938. Encroachment of juniper and deciduous species into the prairie led to rapid closure of these openings. Lynx Prairie declined from 47% prairie in 1938 to 16% prairie in 1971. The patterns of invasion were similar on both sites.

OHIO J. SCI. 83 (1): 22-27, 1983

INTRODUCTION

Prairies constitute a minor portion of the vegetation of Ohio. Yet the existence of non-contiguous prairie in Ohio led Transeau (1935) to describe the Prairie Peninsula as an extension of the tall grass prairie. During the settlement of Ohio, the prairies were converted rapidly to agricultural land. Now all that remains of the Ohio prairies are the relicts often located on less fertile, or less accessible landscapes, which often are preserved by chance alone.

Prairies, especially in the wetter geographical areas, eventually are replaced by forest. This encroachment is endangering the existence of many relict prairies. Our paper examines forest encroachment into 2 prairie areas in Adams County, Ohio.

STUDY SITE

LYNX PRAIRIE. This preserve is located on the southwest slope of Burr Hill, approximately 1 km south of Lynx, Ohio (fig. 1). The soils, derived from Peebles dolomite, generally are shallow and poorly developed. The area is drained by Ellis Run and its tributaries. Currently there are 10 recognizable prairie remnants (fig. 1) within the preserve. These remnants are discontinuous, separated from each other by forest dominated by scrub pine (*Pinus virginiana* Mill.), oaks (*Quercus* spp.), and

[1]Manuscript received 21 July 1981 and in revised form 4 January 1982 (#81-33).

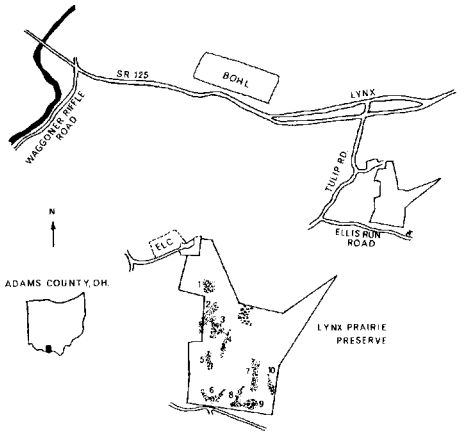

FIGURE 1. Location map of Lynx Prairie and the Bohl property in Adams County, Ohio. The prairies at Lynx are 1) North Prairie, 2) Elizabeth's Prairie, 3) Dock Prairie, 4) Long Prairie, 5) Occidentalis Prairie, 6) Liatris Prairie, 7) Narrow Prairie, 8) Warbler Prairie, 9) Annette's Prairie, 10) Coneflower Prairie. ELC designates East Liberty Church.

red cedar (*Juniperus virginiana* L.). The grassed areas contain numerous species characteristic of the tall grass prairie including big bluestem (*Andropogon gerardii* Vitman), little bluestem (*Schizachyrium scoparium* (Michx.) Nash), Indian grass (*Sorghastrum nutans* Nash), switchgrass (*Panicum virgatum* L.), and side-oats-grama (*Bouteloua curtipendula* (Michx.) Torr.). This land, owned, managed, and protected by the Cincinnati Museum of Natural History, was acquired by the Ohio Chapter of The Nature Conservancy in 1959 in an attempt to save some of the natural prairies in the state. In 1967 this site was designated a Registered Natural Landmark by the National Park Service exemplifying a portion of the natural history of the United States.

BOHL PROPERTY. This site, owned by David T. Bohl, Mount Orab, Ohio, is located approximately 1 km west of Lynx, Ohio, off State Route 125 (fig. 1) just south of the Wilderness (Charles A. Eulett) Preserve. This area contains several small prairies dominated by *A. gerardii* and *S. scoparium* and separated by forests similar to those of the Lynx Prairie Preserve.

Both of the sites are located on the Lynx Quadrangle, 7.5–min series topographic map of the U.S.G.S., available from the Ohio Department of Natural Resources Division of Geological Survey.

METHODS AND MATERIALS

Duplicate negatives of the aerial photographs were obtained from the USDA Aerial Photography Field Office in Salt Lake City, Utah, and the National Archives in Washington, D.C. (table 1). Photographs were printed at a nominal scale of 1:4,400. Distortions due to differences in aircraft altitude and/or obliqueness were minimized by projecting the image from each negative upon one master print and aligning permanent landmarks.

Recognizable units of vegetation were copied to tracing paper. The nonforested areas were classified either as prairie, prairie glades, cultivated field, or pasture. Prairie was defined as openings not bordered by fencelines or hedgerows. Glades were prairie openings with woody species present. Cultivated fields were recognizable as open sites bordered by fencelines or hedgerows and with exposed soil, rows, or plow lines visible. Pastures were defined as openings bordered by fencelines or hedgerows but not having rows or plow lines.

TABLE 1

Aerial photograph identification numbers and sources.

Location	Flight Date	ID No.	Source
Lynx Prairie	28-VIII-1938	BBV-5-28	National Archives
Lynx Prairie	13-X-1950	BBV-3G-120	USDA Aerial Photo
Lynx Prairie	25-X-1965	BBV-1FF-117	USDA Aerial Photo
Lynx Prairie	20-X-1971	BBV-1MM-251	USDA Aerial Photo
Bohl Property	28-VIII-1938	BBV-5-27	National Archives
Bohl Property	13-X-1950	BBV-3G-166	USDA Aerial Photo
Bohl Property	25-X-1965	BBV-1FF-160	USDA Aerial Photo
Bohl Property	20-X-1971	BBV-1MM-208	USDA Aerial Photo

The blackened areas on the photointerpretations represent open prairie, and the white areas represent forest or woodland. Stipple marks were used to indicate various degrees of invasion of woody species in the glades. The lighter stippled areas represent glades with a greater degree of invasion, whereas the darker stippled areas indicate glades in which a lesser degree of woody invasion is evident.

The boundaries of the Lynx Prairie preserve and the Bohl property were superimposed on the photointerpretations. Acetate photocopy transparencies were made of each figure, and the percentage of land supporting prairie at each site was determined with a LiCor 3000 Area Meter (Lambda Corp., Lincoln, NE). When determining these areas fields and pastures were excluded.

RESULTS

The series of aerial photographs (fig. 2) and the photointerpretations (fig. 3) of the Lynx Prairie preserve reveal a dramatic change in land use and forest encroachment during the 33–year span (1938–1971). In 1938, pastures and cultivated fields occupied the north end of what is now the preserve. Fencelines and hedgerows could be seen bordering the fields and pastures. Individual trees (generally juniper, recognized by the conical image) and groves of deciduous and coniferous trees were visible in many of the open areas. The southern portion supported 3 prairie patches connected by glades with widely scattered junipers. Deciduous forests were restricted to the lower slopes of the intermittent stream valleys.

By 1950 most fields and pastures had been abandoned. The initial vegetation to colonize these areas was distinctly herbaceous. Even though these areas most likely contained weedy species, we could not distinguish them from the open prairie regions for our photointerpretations. During this same interval (1938–1950), the prairies of the southern portion of the preserve were reduced considerably by junipers and

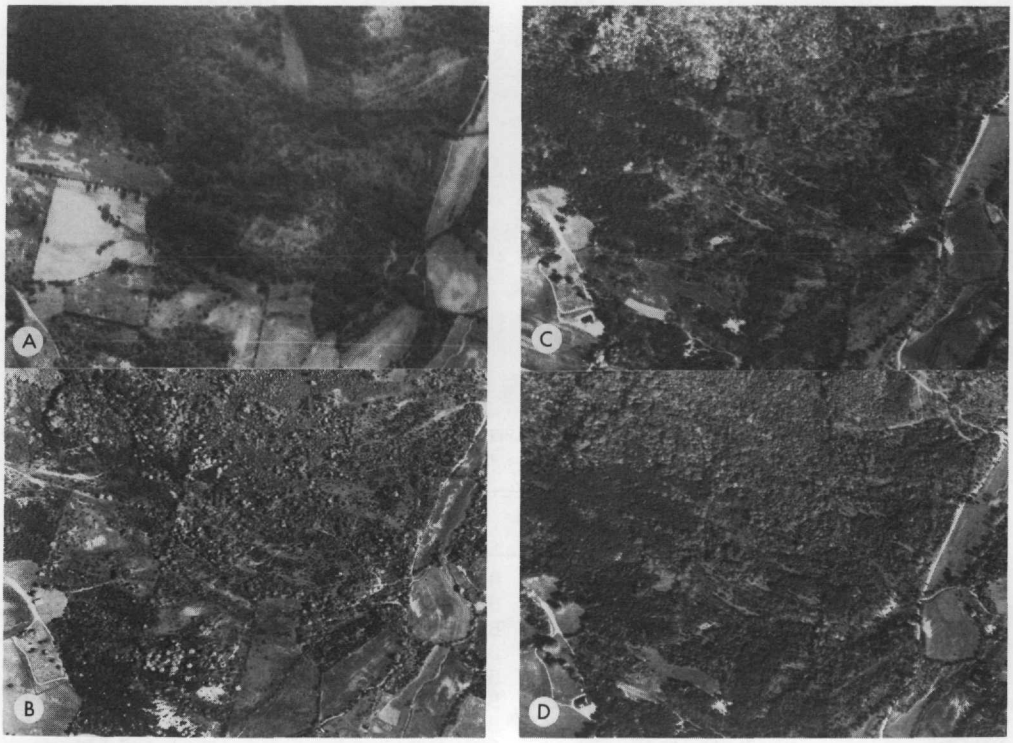

FIGURE 2. Aerial photo of Lynx Prairie: a) 1938, b) 1950, c) 1965, d) 1971.

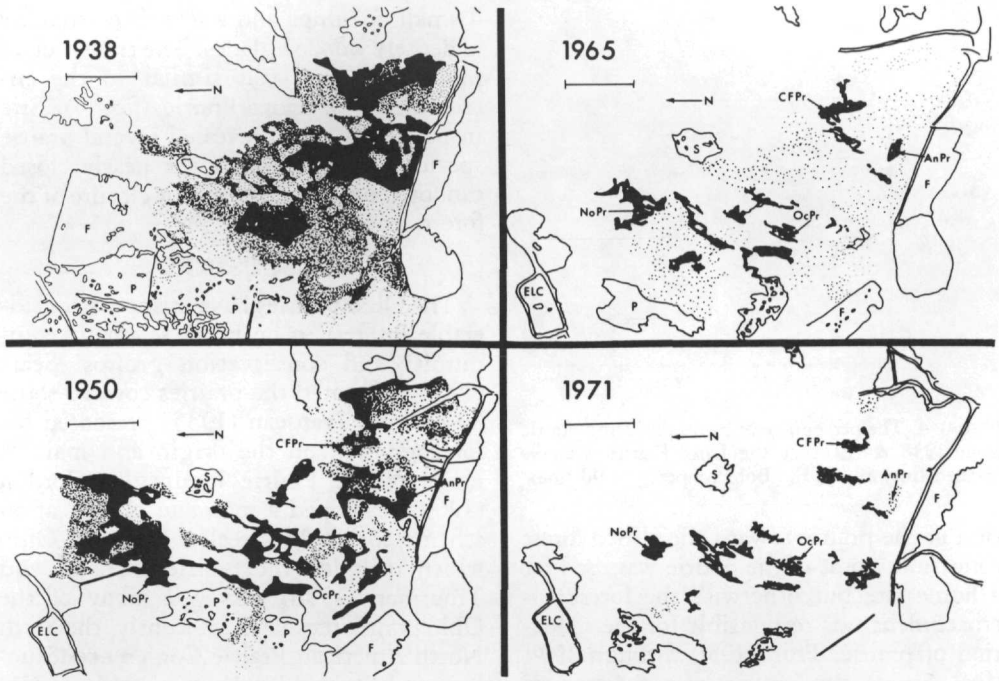

FIGURE 3. Photointerpretations for Lynx Prairie 1938–1971 series in fig. 2. F = field, P = pasture, S = swamp, ELC = East Liberty Church. The bar represents 180 m, CFPr = Coneflower Prairie, NoPr = North Prairie, OcPr = Occidentalis Prairie, AnPr = Annette's Prairie. See fig. 1 for comparison and paragraphs 2 and 3 of the Methods for explanation of stipple pattern.

deciduous species expanding onto the slopes.

The 15–year period between 1950–1965 was characterized by continued expansion of the forested areas into the prairies and prairie glades. The fields and pastures were colonized by deciduous woody species to the extent that they became closed forests. The prairie regions were reduced to scattered "islands" surrounded by deciduous forests mixed with scattered junipers. Small junipers and probably scrub pine occupied the fringes of the islands. North Prairie, which today supports many prairie species (e.g. *A. gerardii, S. scoparium, S. nutans, Liatris squarrosa* (L.) Michx. (blazing star), *Silphium terebinthinaceum* Jacq. (prairie dock), *Ratibida pinnata* (Vent.) Barnh. (greyheaded coneflower)), clearly emerged from the fenceline area which separated the field from the pasture (compare 1971 and 1938, fig. 2 and 3). Coneflower, Annette's, Occidentalis, Warbler, Narrow, and Liatris Prairies (see fig. 1 for locations) are remnants of the larger prairie of 1938. Present day Elizabeth's, Dock, and Long Prairies were pastured in 1938.

By 1971, virtually all the prairie glade region of pre-1965 was converted to closed canopy forest and the prairie remnants were reduced in size. The process of forest encroachment continued at a relatively rapid pace. Between 1938 and 1971 the prairie areas on the preserve were reduced from approximately 47% to 16% (fig. 4).

Forest encroachment into the prairie is not a unique feature of the Lynx Prairie but occurred on the Bohl property as well. The 1938 photographs (interpreted in fig. 5a) indicate this area consisted of forest, cultivated fields, pasture, prairie glades, and prairie. The series of photointerpretations (fig.5) illustrates a relatively rapid transi-

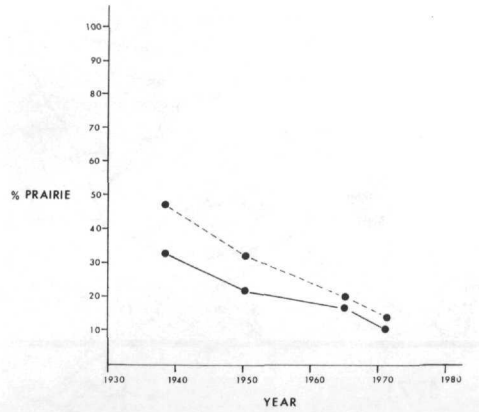

FIGURE 4. The percentage of land supporting prairie from 1938 to 1971 at the Lynx Prairie Preserve (dashed line) and at the Bohl property (solid line).

tion of the prairie toward the closed forest condition. Some of the prairie was used for a home site but otherwise the forest encroachment was responsible for the reduction of prairie. From 1950 through 1971 (fig. 5b–d) the prairie was reduced to 4 small openings and a few thin stretches of densely wooded glades. The transition of prairie to forest was similar to the encroachment at Lynx Prairie (fig. 4). Site inspection in 1980 revealed several prairie species surviving under the nearly closed canopy confirming the recent closure of the forest.

DISCUSSION

The Ohio prairies have attracted considerable interest in both the scientific community and conservation groups. Sears (1926) estimated the prairies covered some 3900 km^2. Transeau (1935) presented his interpretation on the origin and maintenance of the Prairie Peninsula. Gordon (1969) developed a map and classification scheme for 300+ treeless areas of Ohio which included the prairies. Cusick and Troutman (1978) surveyed many of the Ohio prairie remnants. Recently, the Sixth North American Prairie Conference (Stuckey and Reese 1981) was held in Co-

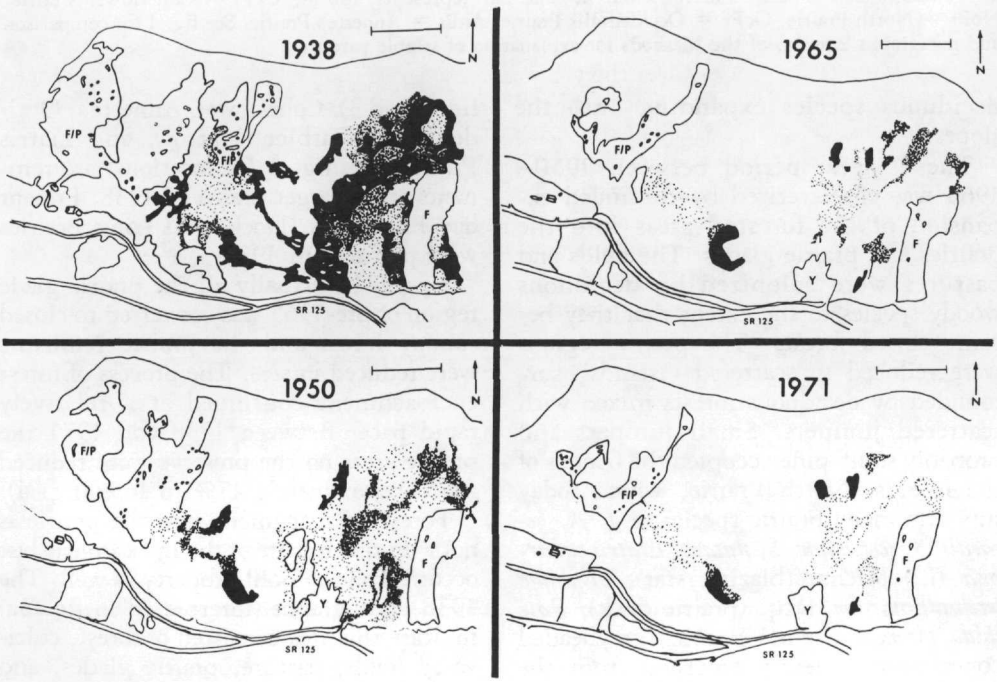

FIGURE 5. Photointerpretations for the Bohl property: a) 1938, b) 1950, c) 1965, d) 1971. P = pasture, Y = homesite, F = field.

lumbus, Ohio, emphasizing topics on the Prairie Peninsula. The Ohio Chapter of The Nature Conservancy and more recently the Ohio Department of Natural Resources have been active in acquiring lands throughout the state to preserve natural areas, including prairie remnants, for scientific, educational, conservation, and aesthetic purposes.

The most thorough description of the prairie remnants of Adams County was by Braun (1928). On the "ridge prairies" she observed that the invasion of several species of deciduous trees and shrubs was eliminating the prairie. However, unlike the "cedar barrens" on Crab Orchard shale, the Lynx Prairie area, on "Cedarville" dolomite, was considered safe (Braun 1928) since ". . . only in a few places. . . is deciduous invasion evident but. . . these (deciduous trees and shrubs) are so scattered and of such slow growth, that their number does not increase."

The edaphic conditions of the prairie remnants in Adams County undoubtedly have helped to retain them. Nevertheless, the successional process clearly is converting these areas to forest. Over the years there have been debates as to whether the origin and natural maintenance of the Adams County prairies was due to climate, soil, natural fire, and/or human activity. Whatever might have been the causes for their continued existence, it is apparent that present conditions will lead to the disappearance of these prairies if active management programs are not pursued. In fact it is highly probable that if tree and shrub removal had not been practiced during the 1970s under the direction of the Cincinnati Museum of Natural History and the Ohio Chapter of The Nature Conservancy, all of the prairies of Lynx Prairie Preserve would have been lost to forest.

ACKNOWLEDGMENTS We would like to thank the Ohio Chapter of The Nature Conservancy and Mr. DeVere Burt, director of the Cincinnati Museum of Natural History, for granting permission to work at the Lynx Prairie Preserve; Mr. David T. Bohl, Mount Orab, Ohio, for providing a tour through his property; and Dr. Richard H. Durrell, University of Cincinnati, and The Nature Conservancy for permission to use portions of the illustrations in fig. 1. Since submission of this manuscript, the Bohl property was donated to the Nature Conservancy and is now part of the Edge of Appalachia Preserve.

LITERATURE CITED

Braun, E. L. 1928 Vegetation of the Mineral Springs region of Adams County, Ohio. Ohio Biol. Surv. Bull. 15, Vol. III, No. 5. p. 383–517.

Cusick, A. W. and K. R. Troutman 1978 The prairie survey project, a summary of data to date. Ohio Biol. Surv. Informative Circ. No. 10. Ohio State Univ., Columbus. 60 p.

Gordon, R. B. 1969 The natural vegetation of Ohio in pioneer days. Ohio Biol. Surv. N.S., Vol. 3, No. 2. 113 p.

Sears, P. B. 1926 The natural vegetation of Ohio. Ohio J. Sci. 26: 128–146.

Stuckey, R. L. and K. L. Reese (eds.) 1981 The Prairie Peninsula — in the shadow of Transeau. Proc. Sixth N. Amer. Prairie Conf. Columbus, OH. 12–17 August, 1978. Ohio Biol. Surv. Notes No. 15.

Transeau, E. M. 1935 The Prairie Peninsula. Ecology 16: 423–437.

EDITOR'S NOTE

The backlog of manuscripts has now been reduced to the extent that new papers can appear in *The Ohio Journal of Science* less than 12 months after acceptance.